OIPE JC699
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PATENT & TRADEMARK OFFICE

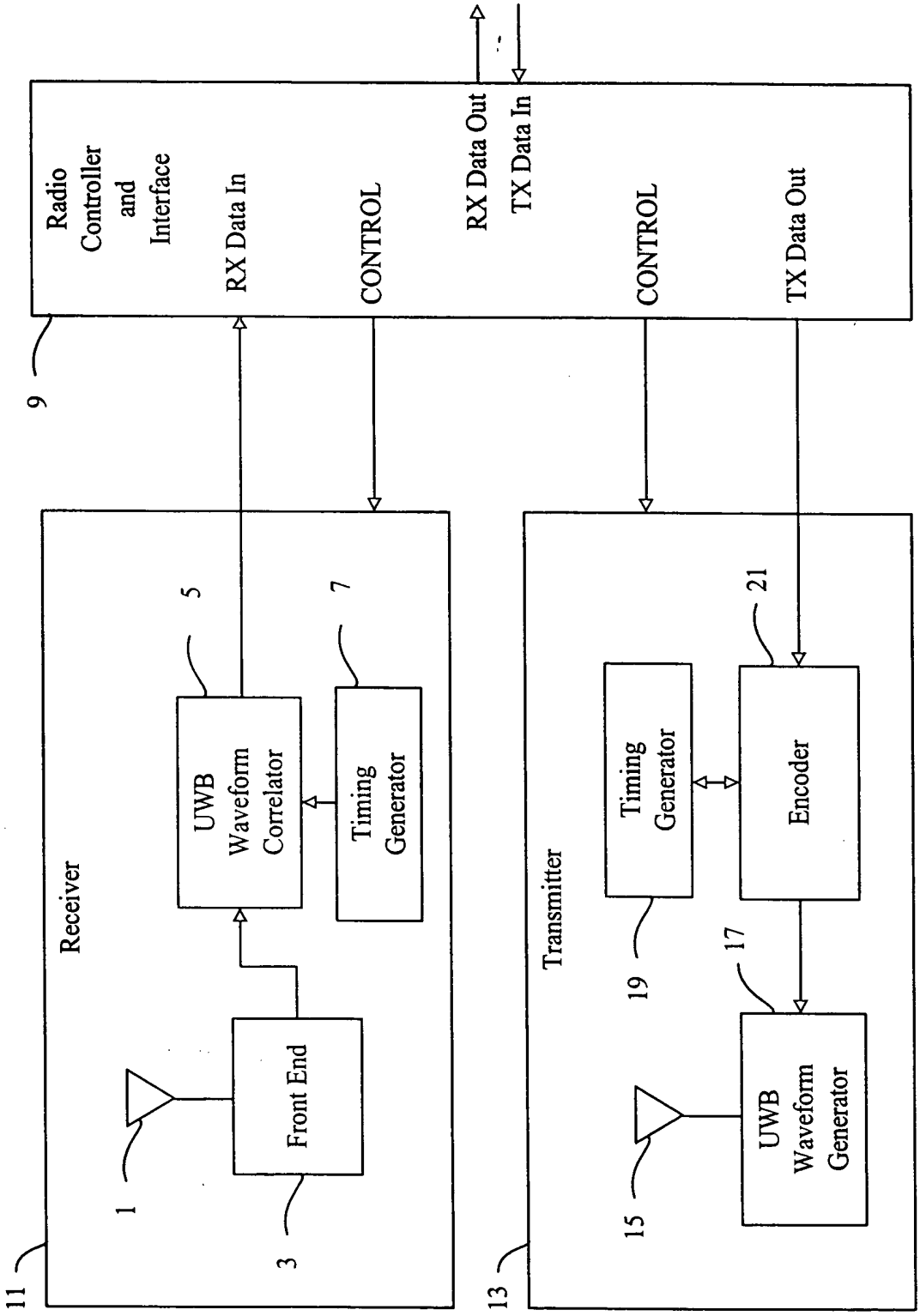


FIGURE 1A

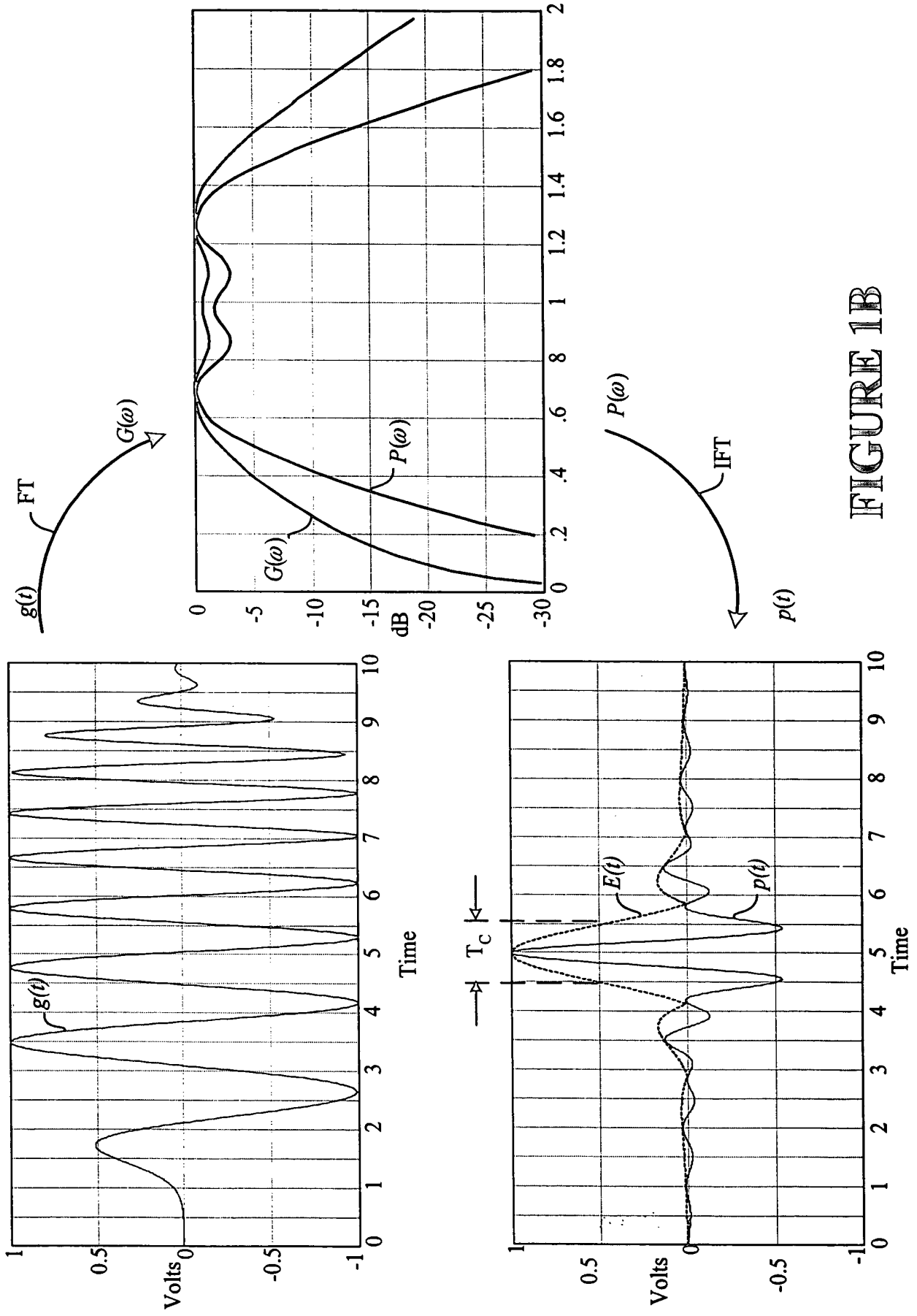

g(t)
FT
G(ω)
G(ω)
P(ω)
dB
0
-5
-10
-15
-20
-25
-30
0
.2
.4
.6
.8
1
1.2
1.4
1.6
1.8
2
P(ω)
IFT
p(t)
g(t)
Volts
Time
Tc
E(t)
p(t)
Volts
Time

FIGURE 1B

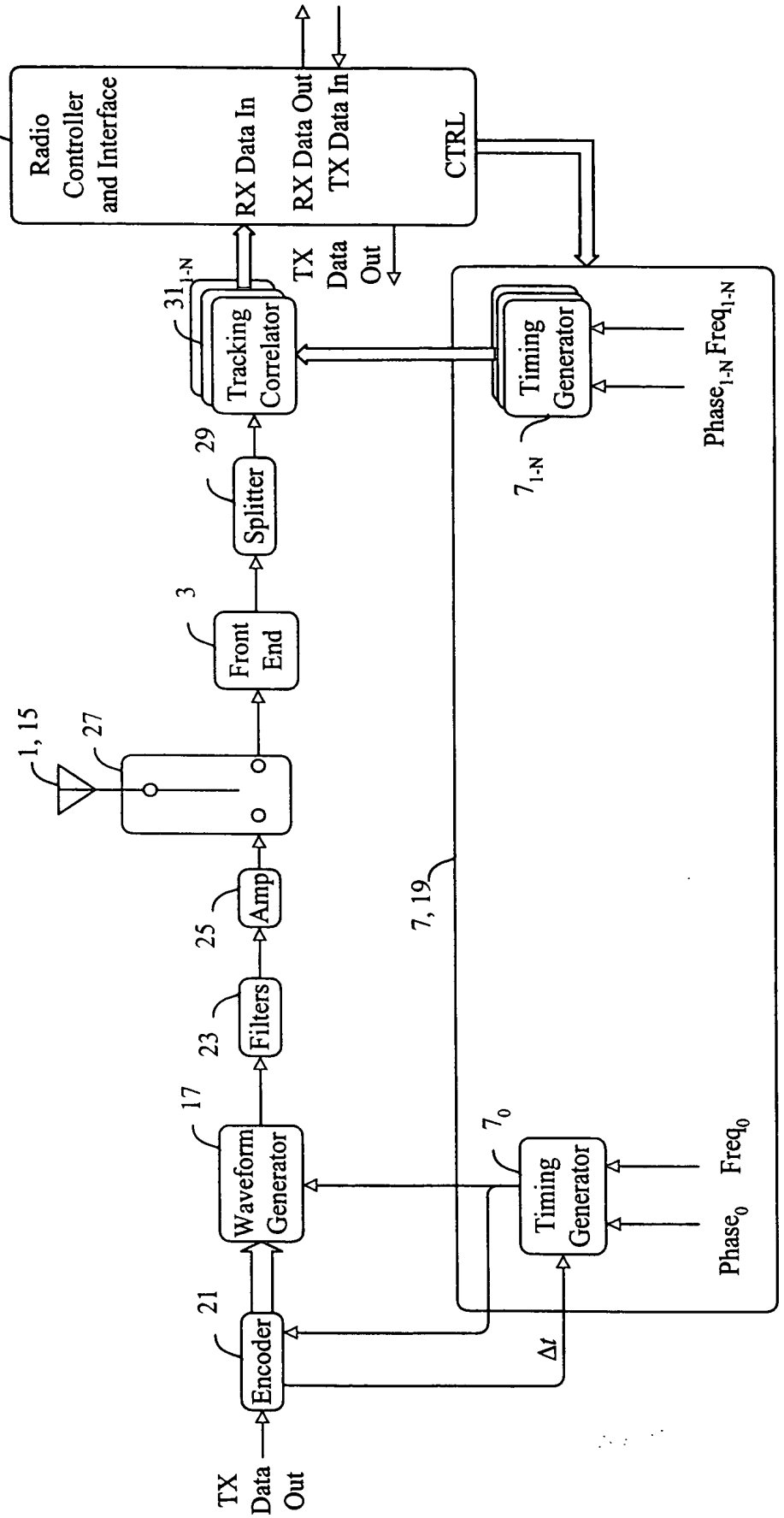

9
Radio Controller and Interface
RX Data In
RX Data Out
TX Data In
CTRL
TX Data Out
31 1-N
Tracking Correlator
29
Splitter
3
Front End
1, 15
27
25
Amp
23
Filters
17
Waveform Generator
21
Encoder
TX Data Out
7, 19
7 0
Timing Generator
Phase0 Freq0
7 1-N
Timing Generator
Phase1-N Freq1-N
Δt

FIGURE 1C

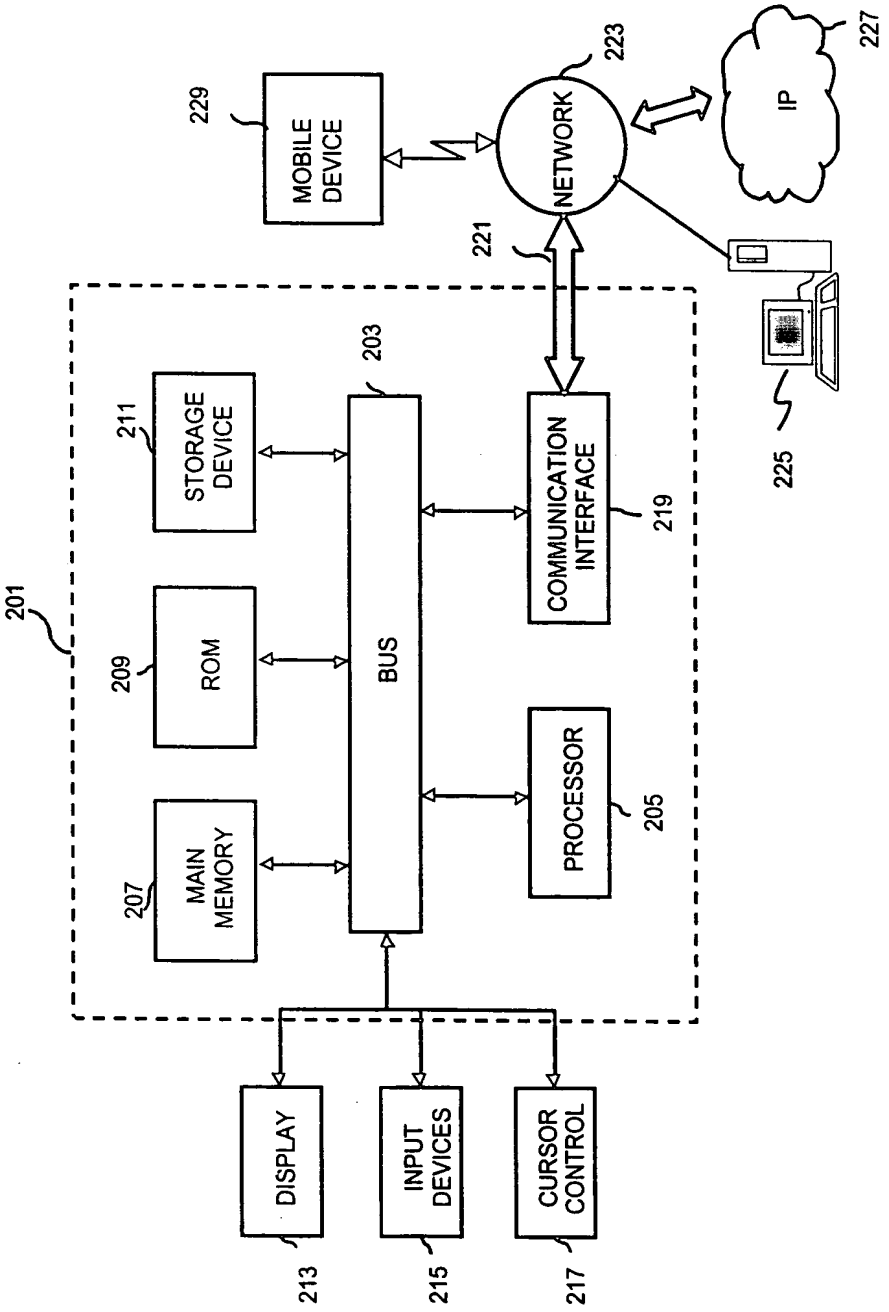

MOBILE DEVICE
229
NETWORK
223
IP
227
221
225
201
203
STORAGE DEVICE
211
ROM
209
MAIN MEMORY
207
BUS
COMMUNICATION INTERFACE
219
PROCESSOR
205
DISPLAY
213
INPUT DEVICES
215
CURSOR CONTROL
217

FIGURE 2

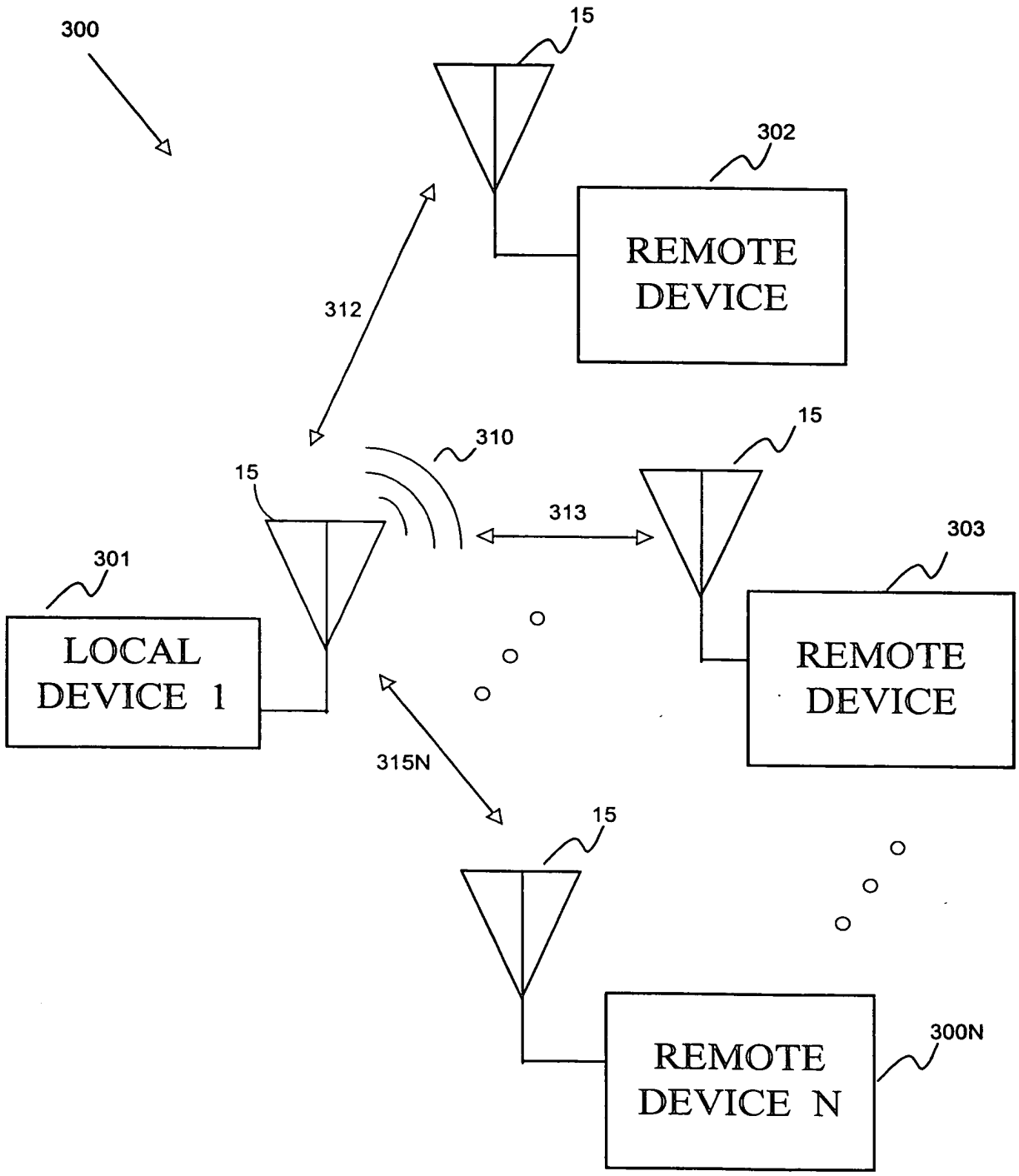

300
15
302
REMOTE DEVICE
312
310
15
313
15
303
301
LOCAL DEVICE 1
REMOTE DEVICE
315N
15
300N
REMOTE DEVICE N

FIGURE 3

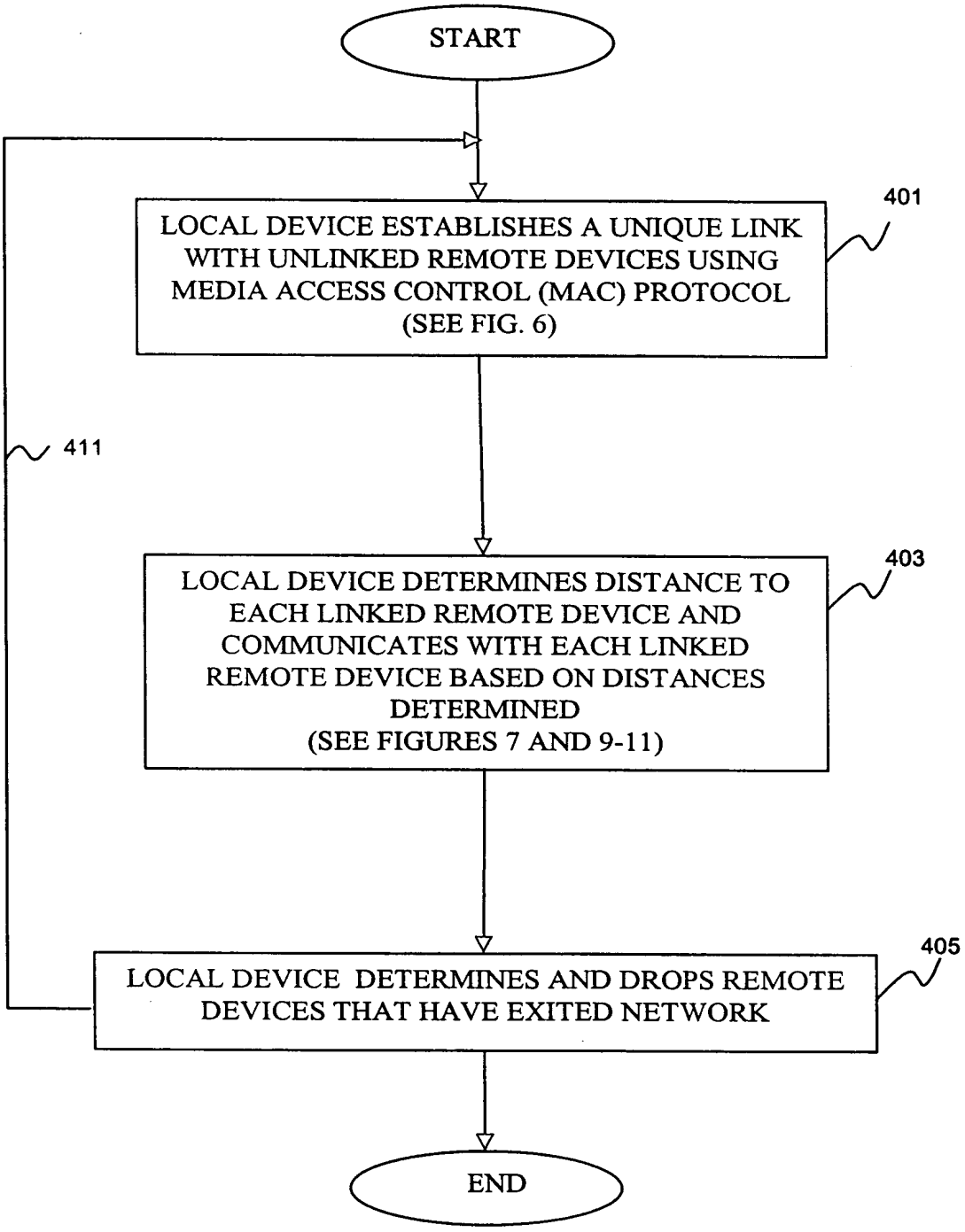

START
LOCAL DEVICE ESTABLISHES A UNIQUE LINK WITH UNLINKED REMOTE DEVICES USING MEDIA ACCESS CONTROL (MAC) PROTOCOL (SEE FIG. 6)
401
411
LOCAL DEVICE DETERMINES DISTANCE TO EACH LINKED REMOTE DEVICE AND COMMUNICATES WITH EACH LINKED REMOTE DEVICE BASED ON DISTANCES DETERMINED (SEE FIGURES 7 AND 9-11)
403
LOCAL DEVICE DETERMINES AND DROPS REMOTE DEVICES THAT HAVE EXITED NETWORK
405
END

FIGURE 4

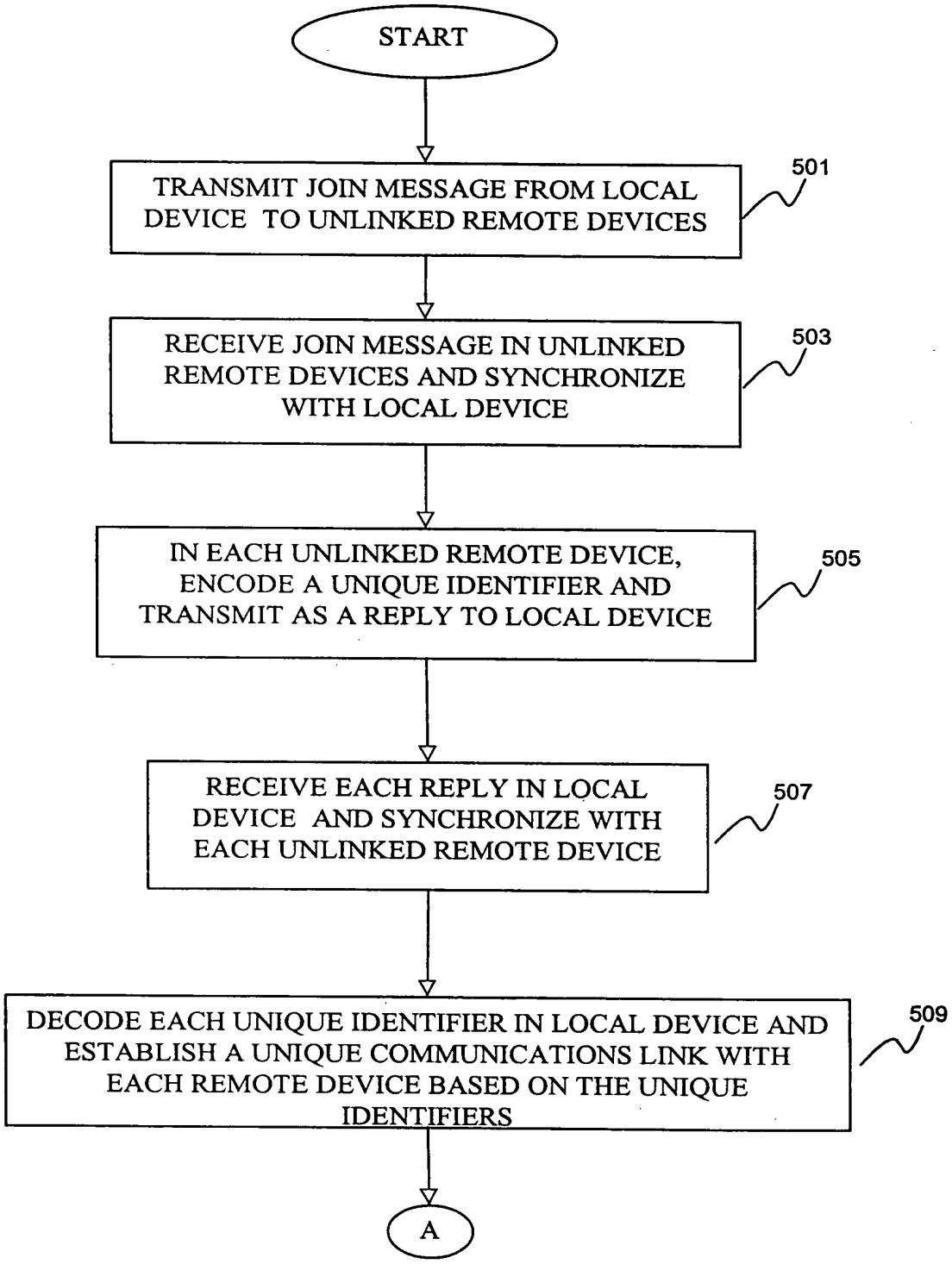

START
TRANSMIT JOIN MESSAGE FROM LOCAL DEVICE TO UNLINKED REMOTE DEVICES
501
RECEIVE JOIN MESSAGE IN UNLINKED REMOTE DEVICES AND SYNCHRONIZE WITH LOCAL DEVICE
503
IN EACH UNLINKED REMOTE DEVICE, ENCODE A UNIQUE IDENTIFIER AND TRANSMIT AS A REPLY TO LOCAL DEVICE
505
RECEIVE EACH REPLY IN LOCAL DEVICE AND SYNCHRONIZE WITH EACH UNLINKED REMOTE DEVICE
507
DECODE EACH UNIQUE IDENTIFIER IN LOCAL DEVICE AND ESTABLISH A UNIQUE COMMUNICATIONS LINK WITH EACH REMOTE DEVICE BASED ON THE UNIQUE IDENTIFIERS
509
A

FIGURE 5

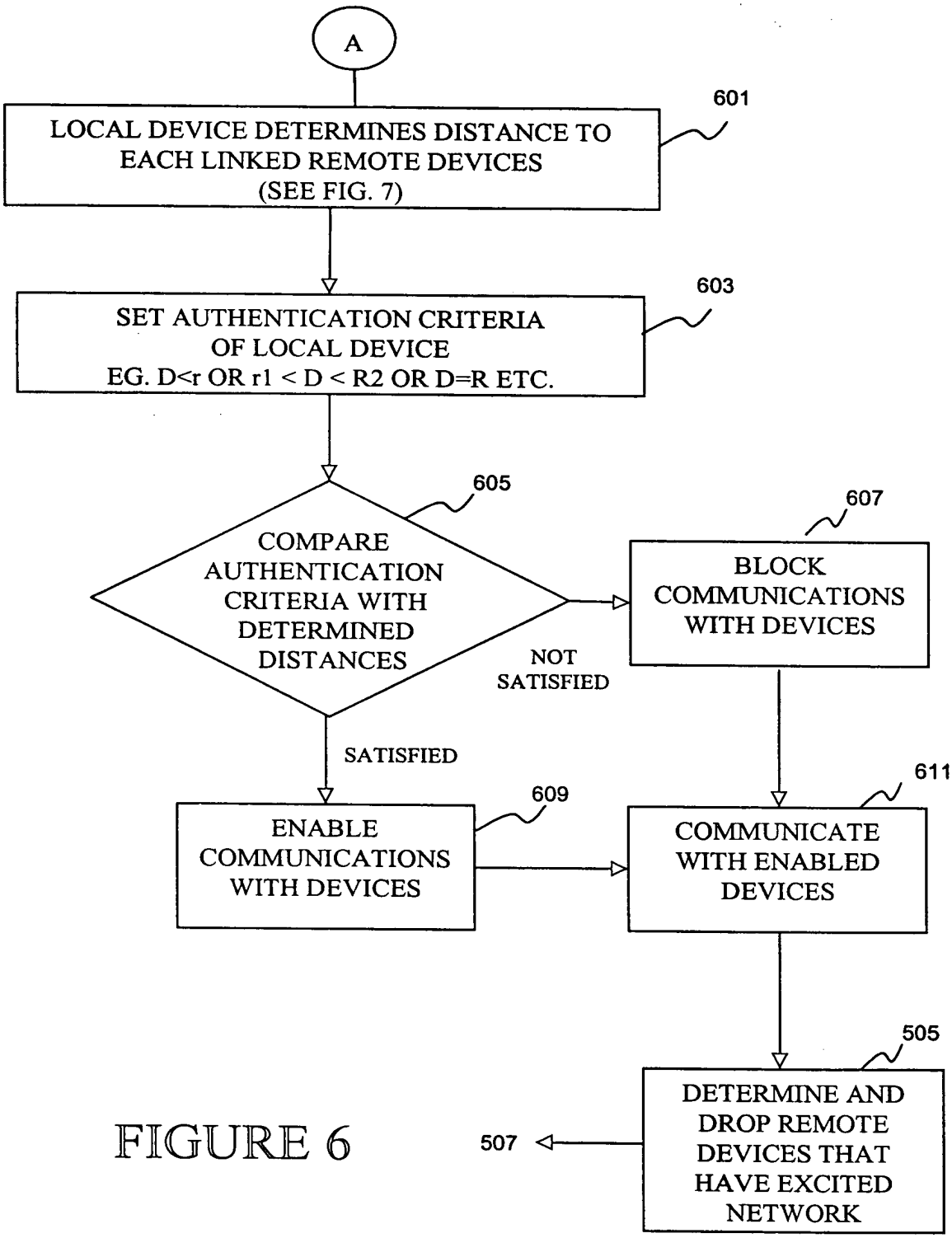

A
LOCAL DEVICE DETERMINES DISTANCE TO EACH LINKED REMOTE DEVICES (SEE FIG. 7)
601
SET AUTHENTICATION CRITERIA OF LOCAL DEVICE EG. D<r OR r1 < D < R2 OR D=R ETC.
603
COMPARE AUTHENTICATION CRITERIA WITH DETERMINED DISTANCES
605
NOT SATISFIED
BLOCK COMMUNICATIONS WITH DEVICES
607
SATISFIED
ENABLE COMMUNICATIONS WITH DEVICES
609
COMMUNICATE WITH ENABLED DEVICES
611
DETERMINE AND DROP REMOTE DEVICES THAT HAVE EXCITED NETWORK
505
507

FIGURE 6

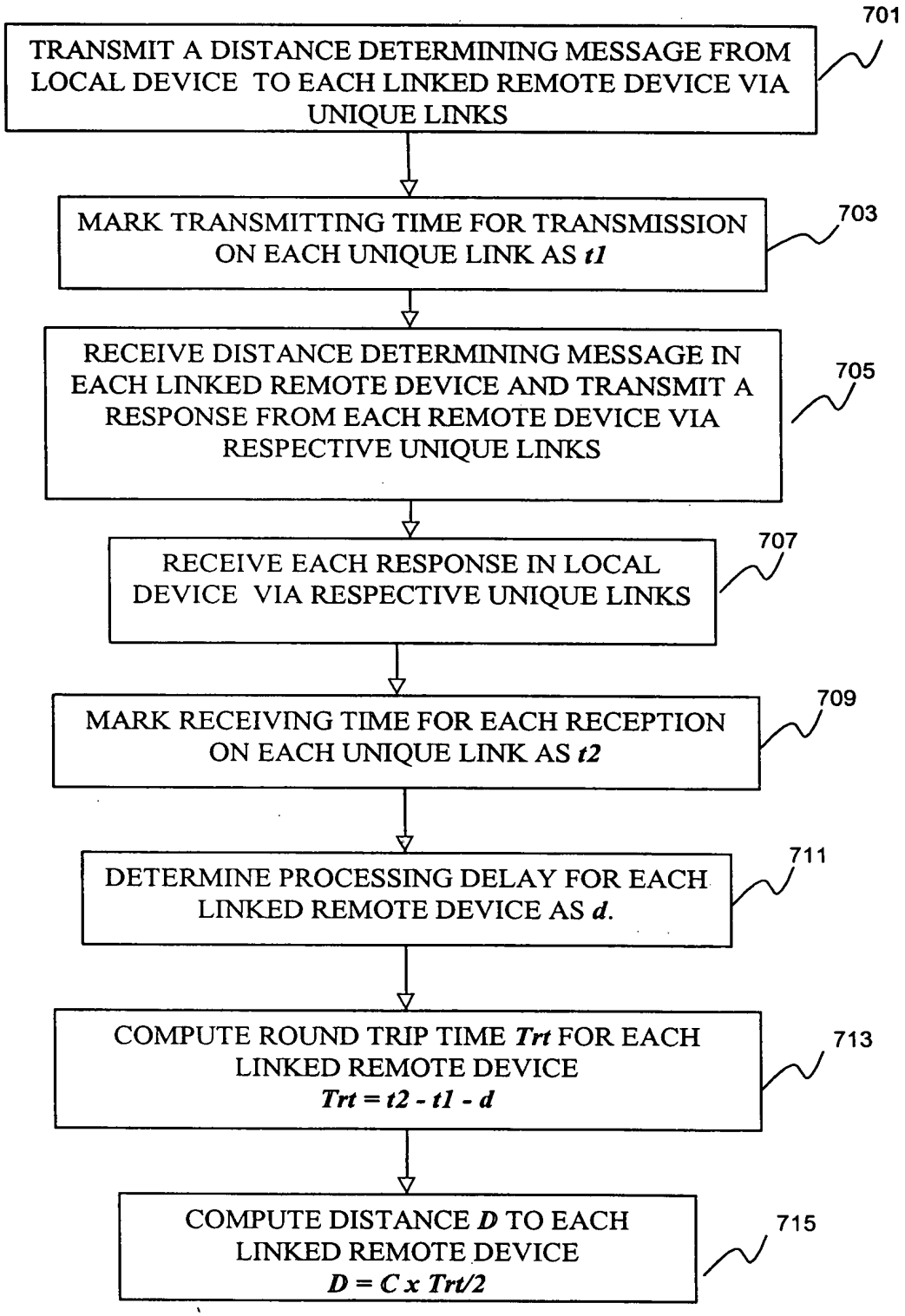
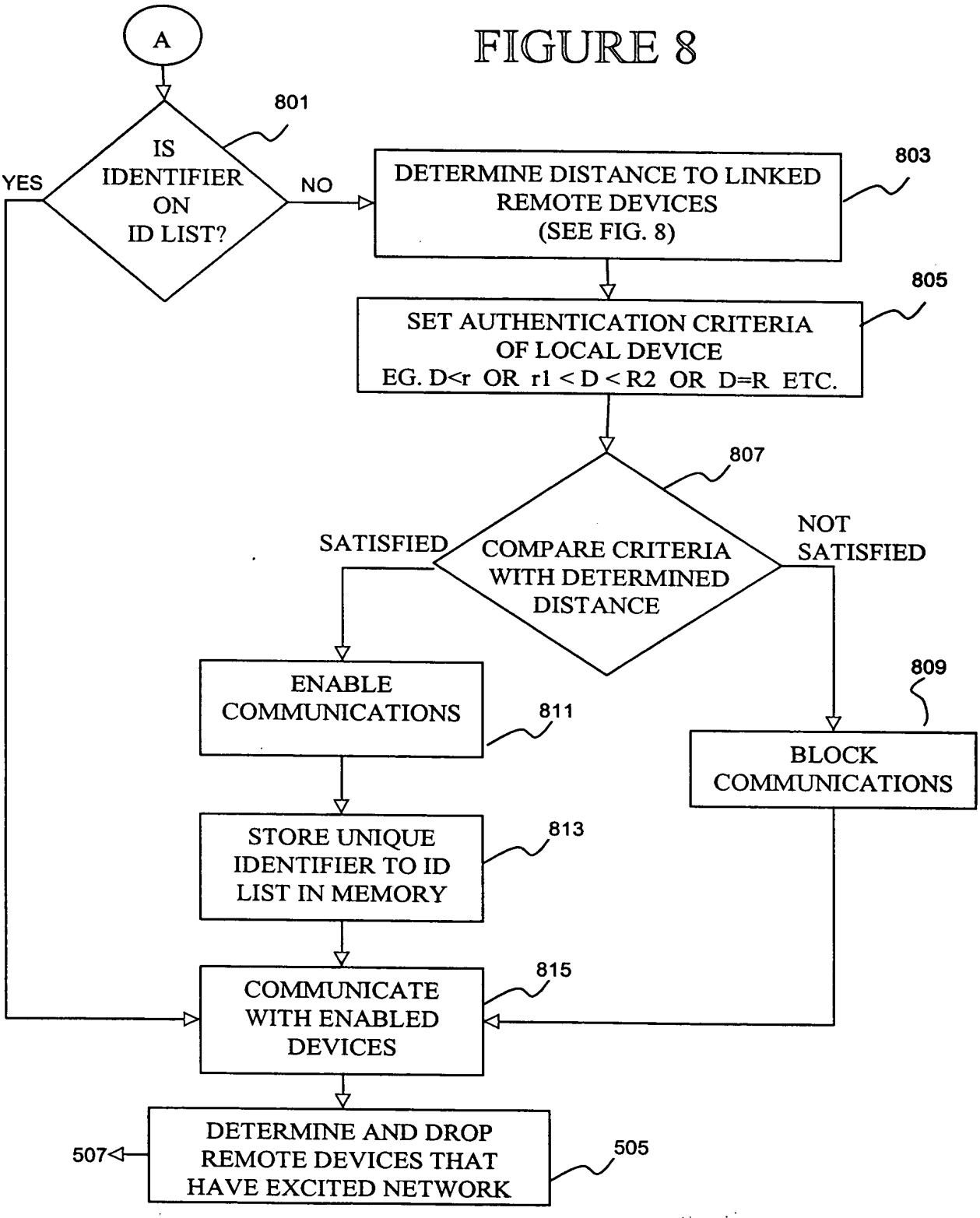

TRANSMIT A DISTANCE DETERMINING MESSAGE FROM LOCAL DEVICE TO EACH LINKED REMOTE DEVICE VIA UNIQUE LINKS
701
MARK TRANSMITTING TIME FOR TRANSMISSION ON EACH UNIQUE LINK AS t1
703
RECEIVE DISTANCE DETERMINING MESSAGE IN EACH LINKED REMOTE DEVICE AND TRANSMIT A RESPONSE FROM EACH REMOTE DEVICE VIA RESPECTIVE UNIQUE LINKS
705
RECEIVE EACH RESPONSE IN LOCAL DEVICE VIA RESPECTIVE UNIQUE LINKS
707
MARK RECEIVING TIME FOR EACH RECEPTION ON EACH UNIQUE LINK AS t2
709
DETERMINE PROCESSING DELAY FOR EACH LINKED REMOTE DEVICE AS d.
711
COMPUTE ROUND TRIP TIME Trt FOR EACH LINKED REMOTE DEVICE
Trt = t2 - t1 - d
713
COMPUTE DISTANCE D TO EACH LINKED REMOTE DEVICE
D = C x Trt/2
715

FIGURE 7

FIGURE 8


A
801
IS IDENTIFIER ON ID LIST?
YES
NO
803
DETERMINE DISTANCE TO LINKED REMOTE DEVICES (SEE FIG. 8)
805
SET AUTHENTICATION CRITERIA OF LOCAL DEVICE EG. D<r OR r1 < D < R2 OR D=R ETC.
807
COMPARE CRITERIA WITH DETERMINED DISTANCE
SATISFIED
NOT SATISFIED
ENABLE COMMUNICATIONS
811
BLOCK COMMUNICATIONS
809
STORE UNIQUE IDENTIFIER TO ID LIST IN MEMORY
813
COMMUNICATE WITH ENABLED DEVICES
815
DETERMINE AND DROP REMOTE DEVICES THAT HAVE EXCITED NETWORK
505
507

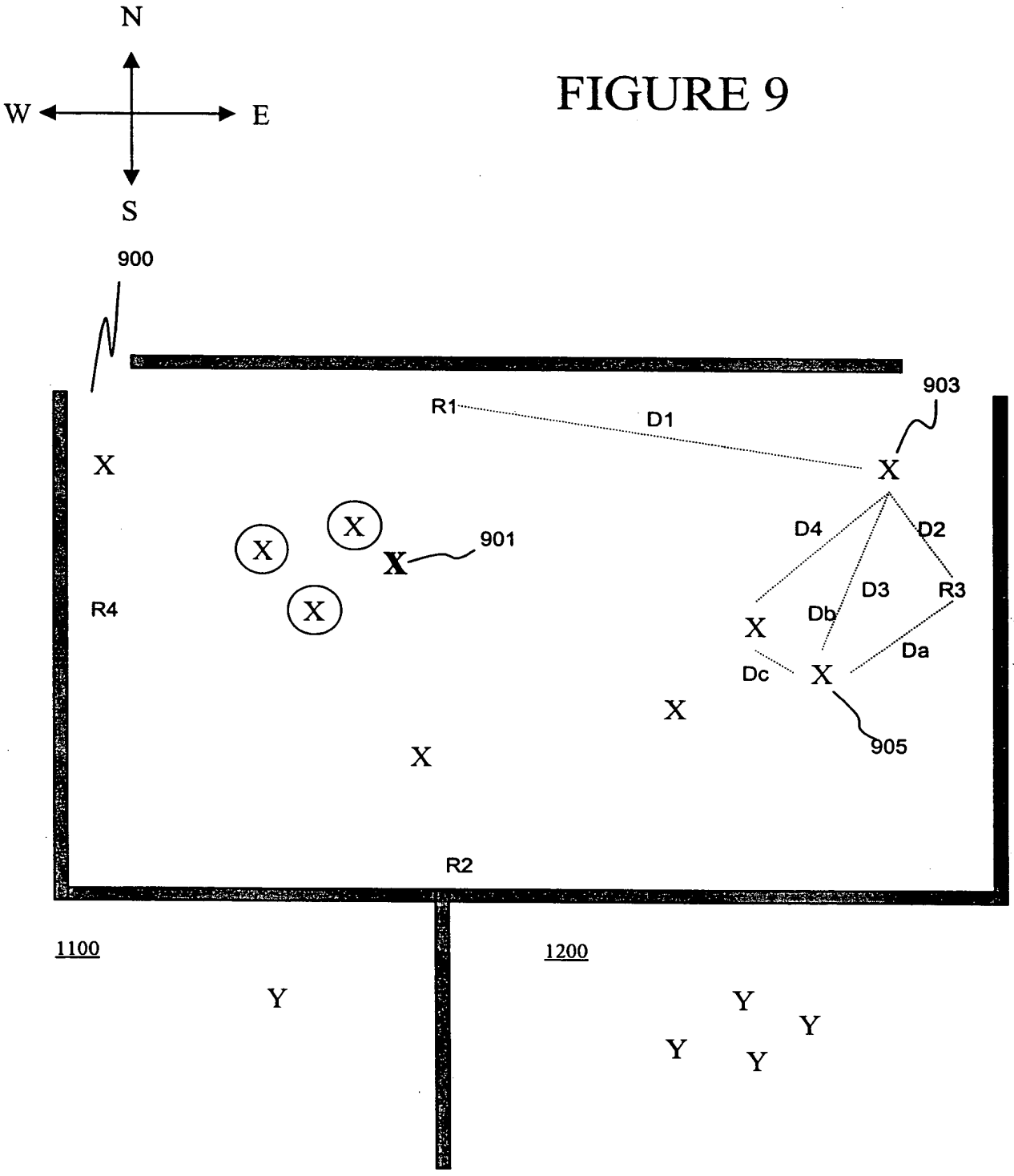


FIGURE 9

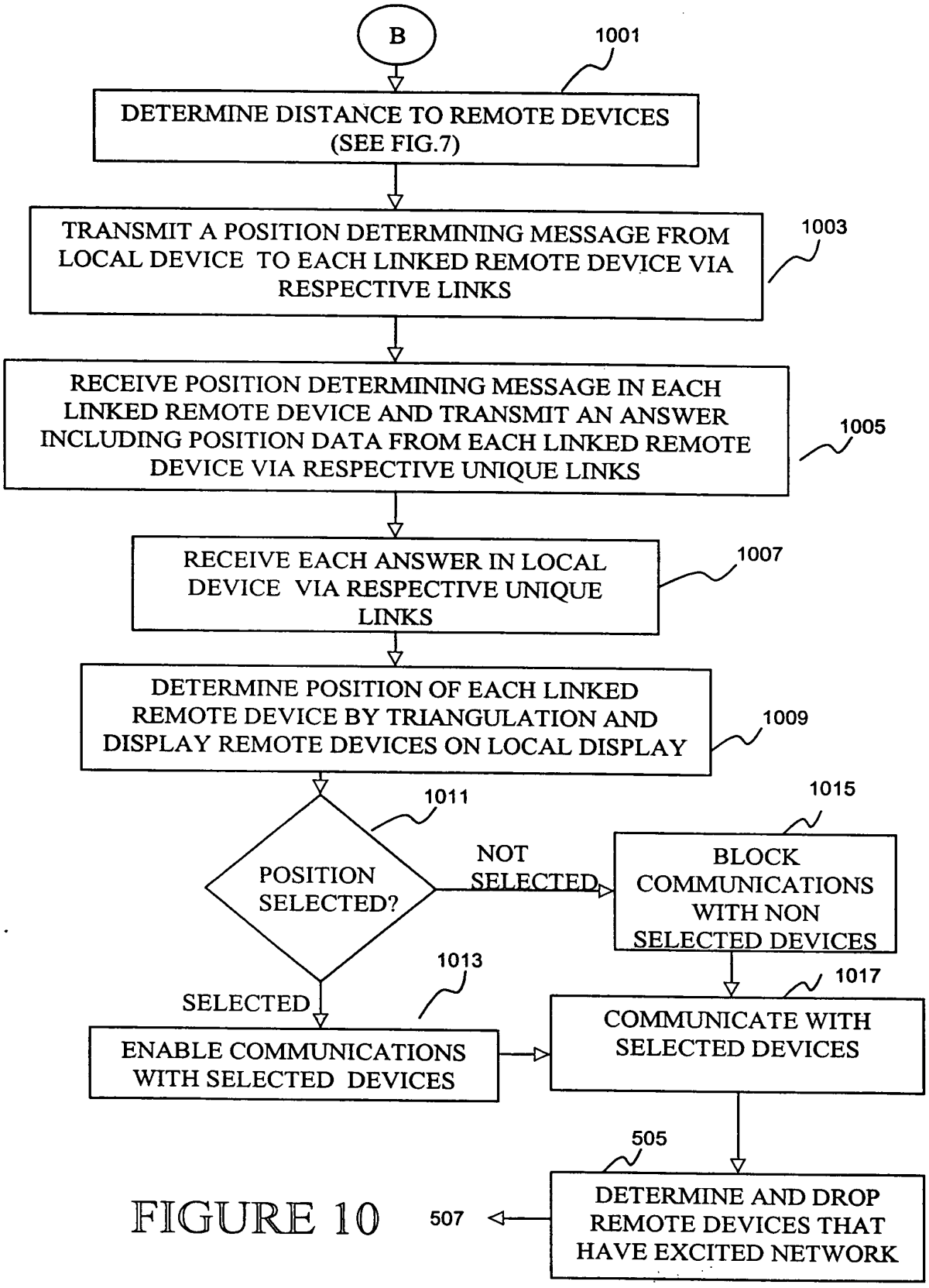

B
1001
DETERMINE DISTANCE TO REMOTE DEVICES (SEE FIG.7)
TRANSMIT A POSITION DETERMINING MESSAGE FROM LOCAL DEVICE TO EACH LINKED REMOTE DEVICE VIA RESPECTIVE LINKS
1003
RECEIVE POSITION DETERMINING MESSAGE IN EACH LINKED REMOTE DEVICE AND TRANSMIT AN ANSWER INCLUDING POSITION DATA FROM EACH LINKED REMOTE DEVICE VIA RESPECTIVE UNIQUE LINKS
1005
RECEIVE EACH ANSWER IN LOCAL DEVICE VIA RESPECTIVE UNIQUE LINKS
1007
DETERMINE POSITION OF EACH LINKED REMOTE DEVICE BY TRIANGULATION AND DISPLAY REMOTE DEVICES ON LOCAL DISPLAY
1009
1011
POSITION SELECTED?
NOT SELECTED
1015
BLOCK COMMUNICATIONS WITH NON SELECTED DEVICES
SELECTED
1013
ENABLE COMMUNICATIONS WITH SELECTED DEVICES
1017
COMMUNICATE WITH SELECTED DEVICES
505
DETERMINE AND DROP REMOTE DEVICES THAT HAVE EXCITED NETWORK
507

FIGURE 10

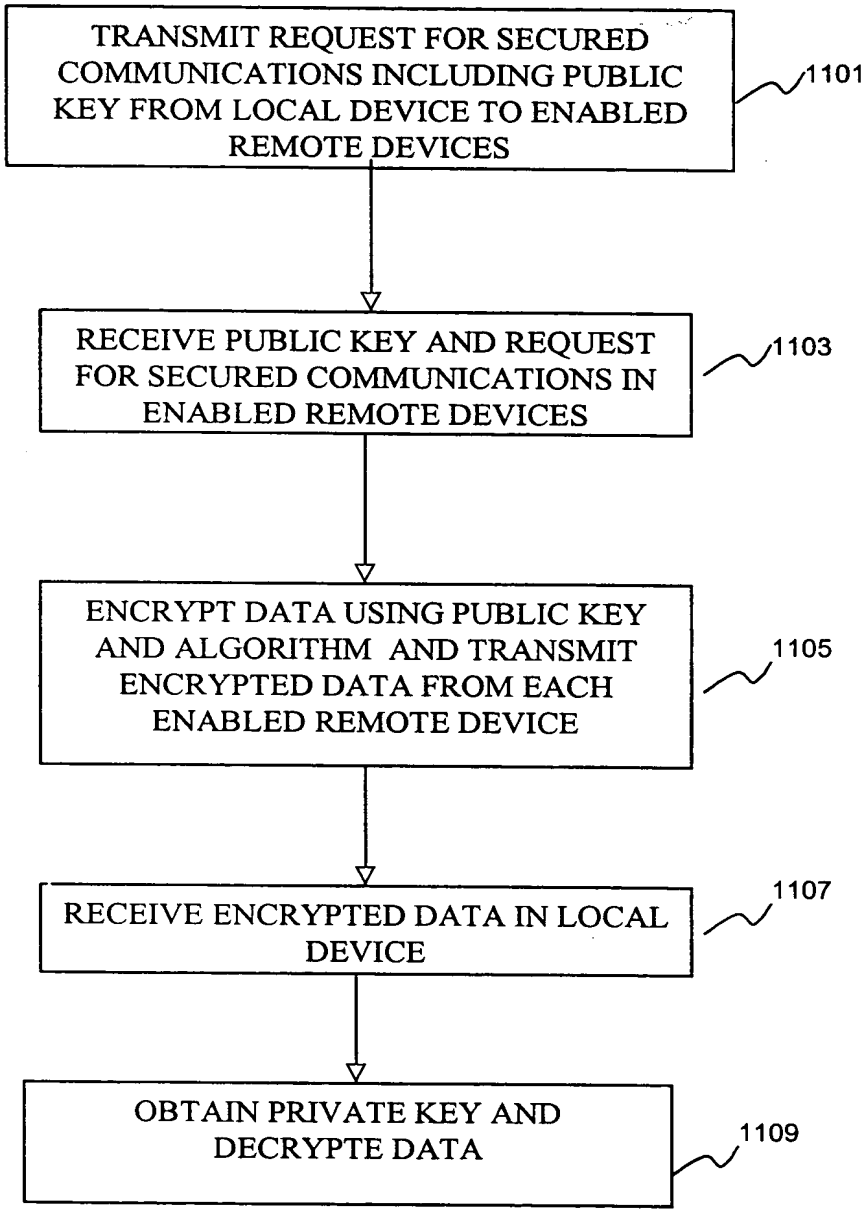

TRANSMIT REQUEST FOR SECURED COMMUNICATIONS INCLUDING PUBLIC KEY FROM LOCAL DEVICE TO ENABLED REMOTE DEVICES
1101
RECEIVE PUBLIC KEY AND REQUEST FOR SECURED COMMUNICATIONS IN ENABLED REMOTE DEVICES
1103
ENCRYPT DATA USING PUBLIC KEY AND ALGORITHM AND TRANSMIT ENCRYPTED DATA FROM EACH ENABLED REMOTE DEVICE
1105
RECEIVE ENCRYPTED DATA IN LOCAL DEVICE
1107
OBTAIN PRIVATE KEY AND DECRYPTE DATA
1109

FIGURE 11